CLAIMS

1. An electric power generating element for a liquid fuel cell, comprising: a positive electrode for reducing oxygen; a negative electrode for oxidizing fuel; and a solid electrolyte placed between the positive electrode and the negative electrode,

wherein the positive electrode and the negative electrode respectively include a catalyst layer with a thickness of 20 μm or more,

at least one of the respective catalyst layers has a pore with a pore diameter in a range of 0.3 μm to 2.0 μm, and

a pore volume of the pore is 4% or more with respect to a total pore volume.

2. The electric power generating element for a liquid fuel cell according to claim 1, wherein the catalyst layer contains, as a catalyst, at least one selected from the group consisting of platinum, a platinum–iron alloy, a platinum–nickel alloy, a platinum–cobalt alloy, a platinum–tin alloy, a platinum–ruthenium alloy, and a platinum–gold alloy.

3. The electric power generating element for a liquid fuel cell according to claim 2, wherein the catalyst is supported on a conductive material.

4. The electric power generating element for a liquid fuel cell according to claim 3, wherein the conductive material is carbon powder.

5. The electric power generating element for a liquid fuel cell according to claim 1, wherein an oxidation catalyst layer for oxidizing liquid fuel is further placed between the solid electrolyte and the catalyst layer of the positive electrode.

6. The electric power generating element for a liquid fuel cell according to claim 5, wherein the oxidation catalyst layer contains an insulating material and a proton conductive material.

7. The electric power generating element for a liquid fuel cell according to claim 5, wherein the oxidation catalyst layer contains a complex material in which a catalyst oxidizing liquid fuel is supported on an insulating material.

8. The electric power generating element for a liquid fuel cell according to claim 5, wherein the oxidation catalyst layer has a porous configuration.

9. The electric power generating element for a liquid fuel cell according to claim 5, wherein a thickness of the oxidation catalyst layer is in a range of 1 μm to 200 μm.

10. A liquid fuel cell comprising the electric power generating element for a liquid fuel cell of any one of claims 1 to 9 and liquid fuel.

11. The liquid fuel cell according to claim 10, wherein the liquid fuel is a methanol aqueous solution.

12. A method for producing an electric power generating element for a liquid fuel cell comprising a positive electrode for reducing oxygen, a negative electrode for oxidizing fuel, and a solid electrolyte placed between the positive electrode and the negative electrode, the positive electrode and the negative electrode respectively including a catalyst layer with a thickness of 20 μm or more, at least one of the respective catalyst layers having a pore with a pore diameter in a range of 0.3 μm to 2.0 μm, and a pore volume of the pore being 4% or more with respect to a total pore volume,

the method, as a production process of the catalyst layer, comprising:

dispersing a material containing a catalyst and a proton conductive material in a solvent;

forming complex particles by removing the solvent to coagulate the material; and

crushing the complex particles.

13. The method for producing an electric power generating element for a liquid fuel cell according to claim 12, wherein the catalyst is at least one selected from the group consisting of platinum, a platinum–iron alloy, a platinum–nickel alloy, a platinum–cobalt alloy, a platinum–tin alloy, a platinum–ruthenium alloy, and a platinum–gold alloy

14. The method for producing an electric power generating element for a liquid fuel cell according to claim 12, wherein the catalyst is supported on a conductive material.

15. The method for producing an electric power generating element for a liquid fuel cell according to claim 14, wherein the conductive material is carbon powder.

16. A method for producing an electric power generating element for a liquid fuel cell comprising a positive electrode for reducing oxygen, a negative electrode for oxidizing fuel, and a solid electrolyte placed between the positive electrode and the negative electrode, the positive electrode and the negative electrode respectively including a catalyst layer with a thickness of 20 μm or more, at least one of the respective catalyst layers having a pore with a pore diameter in a range of 0.3 μm to 2.0 μm, and a pore volume of the pore being 4% or more with respect to a total pore volume,

the method, as a production process of the catalyst layer, comprising:

forming complex particles by granulating a material containing a catalyst

and a proton conductive material.

17. The method for producing an electric power generating element for a liquid fuel cell according to claim 16, wherein the catalyst is at least one selected from the group consisting of platinum, a platinum–iron alloy, a platinum–nickel alloy, a platinum–cobalt alloy, a platinum–tin alloy, a platinum–ruthenium alloy, and a platinum–gold alloy

18. The method for producing an electric power generating element for a liquid fuel cell according to claim 16, wherein the catalyst is supported on a conductive material.

19. The method for producing an electric power generating element for a liquid fuel cell according to claim 18, wherein the conductive material is carbon powder.